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ABSTRACT

This paper describes a study of existing distributions of elementary schools and dwellings, main roads, and local shops, for two Hertfordshire, England, towns. The effects of these factors on the mode of travel of school children, road accidents to child pedestrians, and the shape and mobility of catchment areas were all investigated. Based on the information gained, a reassessment is made of some long-standing assumptions regarding catchment areas; a number of propositions are yielded for use both in reaching planning decisions and in predicting the consequences for the primary education system of decisions on other considerations. (FS)

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THE LOCATION OF PRIMARY SCHOOLS - SOME PLANNING IMPLICATIONS

P. H. Levin, BSc, PhD, and
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Assumptions about primary school catchment areas and the needs of primary school children have played a major part in shaping housing areas in Britain since 1945. This paper describes a study, carried out in two Hertfordshire towns, of the consequences of existing distributions of primary schools and dwellings, main roads and local shops: their effects on the mode of travel of schoolchildren, road accidents to child pedestrians, and the shape and mobility of catchment areas have all been investigated. The information gained has enabled the reassessment of some long-standing assumptions. It has also yielded a number of propositions which should be of use both in reaching planning decisions and in predicting the consequences for the primary education system of decisions based on other considerations.

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BUILDING RESEARCH STATION
Ministry of Public Building and Works

General Meeting of the Institute, held on 20th December 1967 at 26 Portland Place, W1
The President, Dr Wilfred Burns, in the Chair

The location of primary schools

— some planning implications

Dr P H Levin and A J Bruce

The following paper was read by Dr Levin.

I am very glad to have this opportunity to describe to members of the Institute the study that we have made at the BRS concerning the location of primary schools. It is with some deference that I address you: I am all too conscious of the fact that it is the planner who has to make decisions and to bear responsibility, to do a vastly important job very much in the public eye. The researcher can, if he chooses, lead a much more sheltered and secluded life: to make a contribution to knowledge may be regarded as an end in itself. This attitude is not one that my colleagues and I share. In making this study we have felt it to be our responsibility not only to do fundamental research into the interaction between man and the built environment but to present the results in a form that the town planner can use. In other words, we are trying to bridge the gap between fundamental research and practical application, and for this reason I am particularly glad, albeit slightly nervous, to be taking part in a face-to-face confrontation this evening.

This study got under way at the beginning of 1966, and the final report on it was completed in August of this year. It contains a full description of the fieldwork carried out, the data obtained, the analyses made and the inferences drawn. But it is 30,000 words long, with 9 tables and 29 figures: to read it to you would take 4 or 5 hours. I must therefore be selective. First of all, I want to outline the background to this study, the reasons why we started it in the first place, and the objectives that we had. Then I'd like to say a little about the methods that we used and the data that we collected. After this I want to go on to discuss our findings. This involves skipping a very large chunk of the original report in which our observations are described in full: what I want to do instead is to pick out and talk about some of the major ones, and in particular to state what seem to us to be some important implications for planning.

The broad aim of this investigation has been to acquire an understanding of the way in which the plan of a town affects the pattern of human activities accommodated within it. Now, to study simultaneously all the consequences of an implemented plan would necessarily be an exceedingly complex task calling for considerable resources. We have therefore limited our objectives,

aiming in the first instance to identify the major consequences of two existing layouts for just one of the many systems of activities within urban areas, the primary education system. (We are defining system in terms of a central activity, in-school education, and its associated activities, such as travel to school.) We chose primary schools for several reasons. Preliminary observations had shown that there are some primary school children—relatively vulnerable members of the community—who do not have a short and safe journey to school: was this unavoidable? From the point of view of an investigator, the ready accessibility of a good deal of data made the primary education system a particularly suitable starting point for a series of studies in this field. Also the fact that a town contains a number of primary schools enables useful comparisons to be made. A most important consideration was that assumptions about primary education have played—and continue to play—a major part in determining the size and shape of residential areas in new towns and other large new developments. In 1944 the Dudley Report[1] put forward a number of planning principles, based on the assumption that a residential neighbourhood of 10,000 people would not only constitute a 'desirable social unit' but would also allow for two schools for children aged 5–7 (infants) and two for children aged 8–11 (juniors). Among other things, it was maintained that (i) the establishment of residential neighbourhoods is essential for the proper social functioning of towns; (ii) the most usual existing limits of neighbourhoods are barriers, such as railway lines and main highways, to which should be added those formed by belts of open space; (iii) the desirable size for a neighbourhood unit is a population not exceeding 10,000 persons living in an area where every house is easily accessible to the neighbourhood centre; and (iv) primary schools and nursery schools should be near to the centre of the residential area they serve. Although the term 'neighbourhood' seems in recent years to have become a dirty word among planners, the decline of neighbourhoods has seen the proliferation of environmental areas, villages, townships and communities, which have usually satisfied two or three of these principles.

Because urban planning is regarded nowadays as a tool for achieving social goals, planners carry a good deal of responsibility for deciding what social goals to aim at, and for deciding on the physical means—the planning policy—by which they are to be attained. It must not be forgotten, however, that central and local government has at its command a number of other tools, in addition to urban planning, by which social objectives may be gained, and these tools often interact with urban planning. The extent of a school's catchment area will depend, for example, on the size and density of dwellings—a matter for planning policy—and on the annual intake (and hence the number) of children in the school—a matter for educational policy. As far as a planner is concerned, educational policy can, reasonably enough, be bracketed as a factor beyond his control. However, planning decisions, once implemented, are virtually fixed for the life of the artefacts, whereas the conditions under which the artefacts are used (e.g. birth rate, educational aspirations) are likely to change. Perhaps there should therefore be an onus on the planner to ensure that his decisions restrict as little as possible the scope for educational policy, which is obviously capable of far quicker response to changing conditions. This would evidently be one way in which the planner could allow for future growth and change, and we have tried to discover how this might be achieved.

In order to define a research problem it is necessary to have some background of experience against which the problem can be recognized. A study such as this one is, therefore, necessarily approached not with a blank and entirely open mind but with preconceptions and expectations, and these inevitably affect the procedural decisions which the investigator must make—decisions, for example, as to what data should be sought, and in what quantity, and how it should be analysed. These decisions are also governed by the nature and accessibility of the data, and the available resources for collecting and processing it.

At the beginning of the study it was taken as axiomatic that the behaviour and subjective feelings of the human components of a system of primary education—children, parents, teachers, etc.—would be governed in part by the physical plan or layout of the area in which the system was situated and in part by other factors not within a town planner's control such as birthrate, family structure, educational decisions. But of course the activities and behaviour of one person will in addition affect and be affected by the activities and behaviour of other people. For this reason we felt that in investigating the functioning of a system involving large numbers of people it was advisable to take as a starting point the behaviour pattern as a whole. This led us to base this study on clusters of schools, which would allow some investigation of the behaviour patterns centred on adjacent schools. In addition it would enable more satisfactory comparisons to be made between schools, as adjacent schools would necessarily have a number of things in common. It was further decided that part at least of the study should be carried out in a new town, and that for comparison purposes an 'old' town of approximately the same size should also be investigated. Because of the limited resources at our disposal, the study was carried out in only two towns—Stevenage and St Albans—and covered approximately half the area of each town.

A good deal of highly accurate information was gained in the first instance by visits to the 34 schools covered in the study. From the registers we abstracted the name, address, age and class of each child (a total of over 9,000 children). This gave us information on the incidence of siblings at primary school, age differences between siblings, class sizes, the number of classes in each school, and the total number of children in each school. The addresses gave us a complete 'origin and destination' survey, and the home of each child was plotted on large-scale (1:1250) maps: from these we were able to measure the length of the shortest practicable route from home to school for pedestrians and to observe the number and kind of roads necessarily crossed.

For infants a complete mode-of-travel survey was also carried out. Class lists were typed on to questionnaire blanks and the class teachers asked to state each child's usual mode of travel to and from school and whether the child stayed for lunch.

From police records we collected information on road accidents to child pedestrians aged 5–11 years that occurred during 1962–66 in Stevenage and St Albans. We have also had access to measurements of traffic flows on main roads in the two towns.

Another major source of information was a number of interviews with parents. 140 homes in Stevenage and 84 in St Albans were visited and the parents were asked a number of questions on mode of travel and the reason for it, their assessment of the safety and shortness of the journey, lunch habits and the reasons for them, whether the parents had had any say in choosing the school, where the husband (and wife if applicable) worked, family size, car ownership, and shopping habits. These interviews were intended to provide some understanding of the reasons behind the behaviour on which data had already been obtained rather than to constitute a statistical survey in its own right. Interviews with head teachers and spot observations of the number of adults meeting children after school and of the number of children going home by car served to complete the picture.

The data which we collected from these various sources took the form of measurements both of the behaviour of the system (e.g. accident statistics, the geographical distribution of school children, and the mode of travel of individuals) and of opinion (e.g. the answers to questions which were put to parents). These measures of behaviour and opinion are dependent variables: they are of course criteria by which the functioning of the system (and by implication the effects of planning decisions) can be measured.

In the main however the 'behaviour criteria' are not in themselves meaningful to the individuals concerned—to children, parents, teachers or administrators—certainly not meaningful in the sense of being measures of the stimulus given by the system to the individuals and to which observed behaviour is a reaction. For example, a parent does not react to the geographical distribution of school children but to the possibility of choosing which school his child will attend. The two are related, but it is the possibility of choice that matters. Similarly it is not so much the accident statistics but rather the estimated

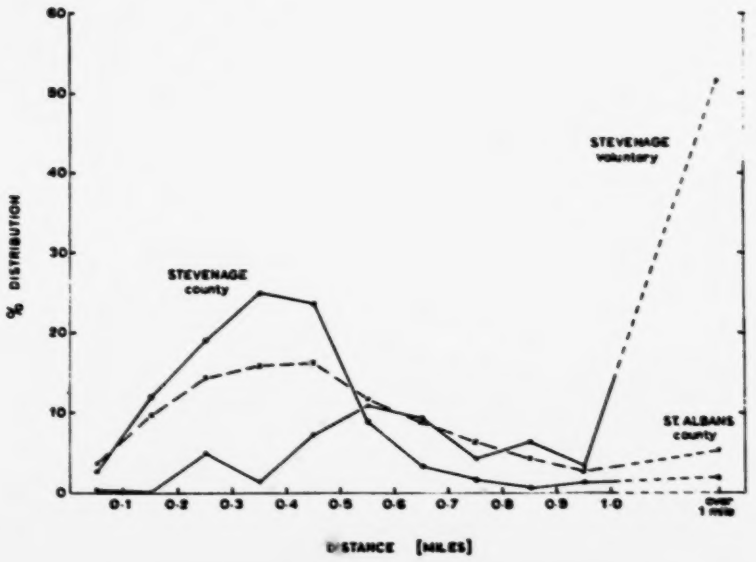


Fig. 1: the percentage distribution of infants, by walking distance from home to school

safety of a particular child's journey that determines whether one of his parents accompanies him. It will be useful to categorize the possibility of choosing a school and the safety of a journey as 'qualities' of the system, and in the remainder of this paper I want to discuss these and other qualities and their dependence on the physical plan, under four main headings:

a The accessibility of a school to children.
b The safety of the journey to school.
c The accessibility and 'draw' of a school to parents.
d System flexibility and the freedom of choice of school.

Under each heading an attempt is made to associate each quality with certain identified criteria—i.e. with measures of behaviour and opinion. Even if this is done successfully, one must still face the difficulty that an investigation such as this one cannot of itself show what is desirable and what is not. All that it can do, if successful, is to enable one to predict what the consequences of a given plan might be, the consequences being expressed in terms of the identified criteria. It is then for the policy-maker to decide whether the predicted consequences are tolerable or not. He is likely however to look for guidance to recommendations such as those contained in the Plowden Report,[2] and we have accordingly done the same. A few goals are of course self-evident—the elimination of road accidents to children, for example.

The accessibility of a school to children

In figure 1 is shown the distribution of all distances under a mile for infants at three categories of school—county, Stevenage; voluntary (RC and C of E) Stevenage; and county, St Albans. For the county schools, the most common distance is very close to 0·4 miles in both towns, but the St Albans peak is lower and the tail correspondingly longer. 6·6% of children travel more than a mile as opposed to 2·0% in Stevenage. The distribution for the voluntary schools in Stevenage is quite different from both of the others. Only 1 child in 15 lives within 0·4 miles walking distance from school, and slightly over half travel more than 1 mile.

As one would expect, the proportion of children in a distance group who have to cross a main road increases with distance. This is shown, for infants attending county schools in the two towns, in figure 2. For both Stevenage and St Albans there is a dip at about 0·8 miles in an otherwise rising curve. This seems to result from the catchment area of a school extending in practice farthest in the direction in which it has no main road to cross. In other words, there is a tendency for boundaries to be drawn such that a child who has to travel more than three quarters of a mile or so is less likely to be required to cross a main road than one living half a mile away. At distances of a mile or more, however, a crossing begins to become inevitable, especially in St Albans. (Broadly speaking, the term 'main road' covers the primary and district distributors in Stevenage and the radial and ring roads in St Albans. We have included in the category of children crossing neither those using underpasses nor the few children living in houses situated on the main road.)

Among the infants population as a whole, in both towns, the majority walked to or from school neither with an adult nor under the care of an older child: we have termed this the W mode. Dividing the children into ten age groups, and plotting against age the percentage of children in each age group using this mode, one obtains the graphs shown in figures 3 and 4 for the am and pm journeys in Stevenage and St Albans respectively. As can be seen, this percentage rises with age and is consistently higher in Stevenage than in St Albans and in the afternoon than in the morning.

The decrease with distance of the percentage using the W mode is shown in figures 5 and 6. It can be represented quite well by a straight line, for both afternoon and morning journeys. For the latter, the decrease over 1/10 mile is 7·6% in St Albans and 6·5% in Stevenage. This suggests that distance, or some correlate of distance—such as perceived hazard, perhaps—has a greater effect on the chosen mode of travel to school in St Albans. This difference between the two towns is even more apparent when one looks at the afternoon journeys.

It must be borne in mind that the 'age graphs' for Stevenage and St Albans are not directly comparable, because distances to school are on the whole greater in St Albans. The 'distance graphs', on the other hand, are more comparable: we have found that there is no correlation between the age of a child and the distance from his home to school, and so each group on the distance scale has the same average age, which is very nearly the same in both towns. It is from figures 5 and 6 therefore that one concludes that a child's mode of travel to school is determined not only by age and distance but by other factors that are of different strengths in the two towns.

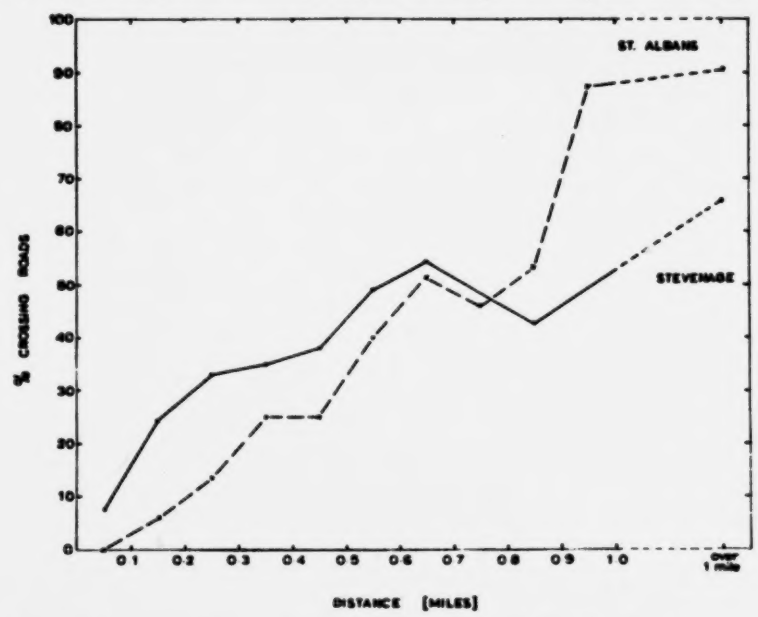


Fig. 2: the percentage of infants at county schools having to cross main roads, by distance

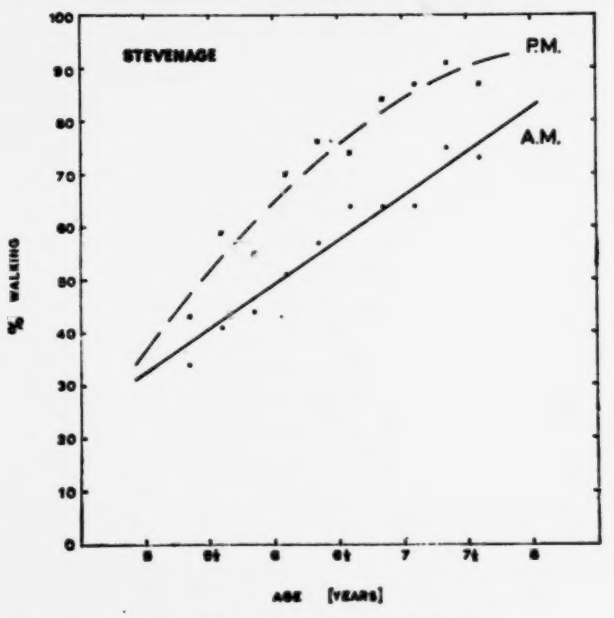


Fig. 3: the percentage of infants walking unescorted (W mode), by age

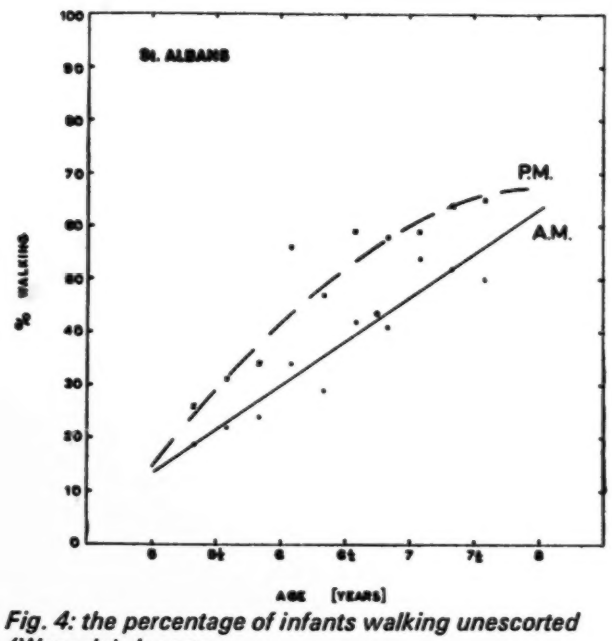


Fig. 4: the percentage of infants walking unescorted (W mode), by age

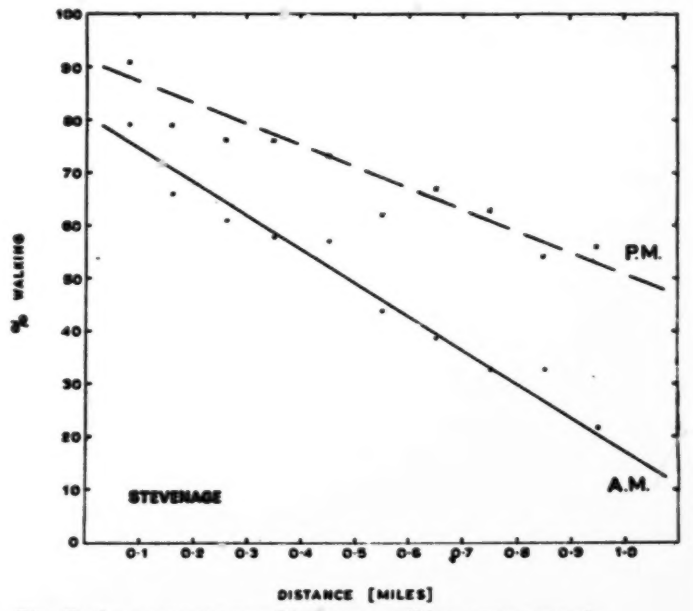


Fig. 5: the percentage of infants walking unescorted (W mode), by distance.

Besides those children who walk unescorted to school, there are significant numbers who walk escorted by an adult or by an older child, or who travel by car. We have analysed the variation with distance of the proportion of children using the most important pairs of modes (the pair referring to the morning and afternoon journeys) for two large groups of children—those infants who are the only members of their families at the school ('solo' infants) and those who have one or more older siblings in the junior department of the same school. Among both groups there were significant differences between Stevenage and St Albans, and between those children who crossed a main road and those who did not. As one would expect, we found that significantly fewer of the 'solo' children were escorted by older children. This demographic factor makes the difference between figures 5 and 6 even more difficult to account for, since there are proportionately fewer 'solo' children in Stevenage than in St Albans.

How can the measurements which we have made help us to reach a definition of 'accessibility'? Everyone knows what is meant by accessibility, but, although there is general agreement that a school needs to be accessible to children, there exists no means by which accessibility may be measured. However the Reith Report[3] suggested that the maximum distance from home to school should be half a mile and it would certainly seem reasonable that accessibility should decrease as distance increases. Given that, is there any behavioural measure that we have identified which can be associated with accessibility?

The paired mode of travel most strongly dependent on distance is the CC mode—use of a car in both directions—especially if one takes distances above a mile into account. It is also likely to result from a more positive motivation than is the WW mode, for example. Thus, although the number of children using the CC mode is on the small side it is the best behavioural indicator available that could be taken as a measure of accessibility or inaccessibility. It is not perfect, of course, since it depends on factors other than distance, as is shown by the difference between Stevenage and St Albans and by the fact that although a school does not become less accessible in wet weather, car usage rises noticeably then.

In neither town is any use made of the CC mode for journeys of under 0·4 miles (pedestrian route). Between 0·4 and 1·0 miles the numbers using it in Stevenage are insignificant, but in St Albans they amount to some 13% of the total. Above a mile, the CC mode becomes a major one in Stevenage as well, being used by 32% of all children travelling more than a mile. The comparable figure in St Albans is 45%.

This variation with distance, although somewhat imprecise, tallies quite satisfactorily with the answers given by interviewed parents when asked if the school was reasonably near. In both towns the lowest distance at which a school was felt to be not reasonably near was fractionally below 0·5 miles. The highest distance at which a school was felt to be reasonably near was 1·0 miles in Stevenage and 0·9 miles in St Albans. For distances in the range 0·5–0·9 miles, the verdict of 'not reasonably near' was given much more frequently in St Albans. Thus both travel habits and interview responses suggest that a school less than 0·4 miles' walk from a dwelling will be regarded by parents as accessible even to a 5-year-old child on foot, while a school more than a mile away will be regarded as inaccessible. At intermediate distances the level of accessibility for a child of a given age will depend on local conditions.

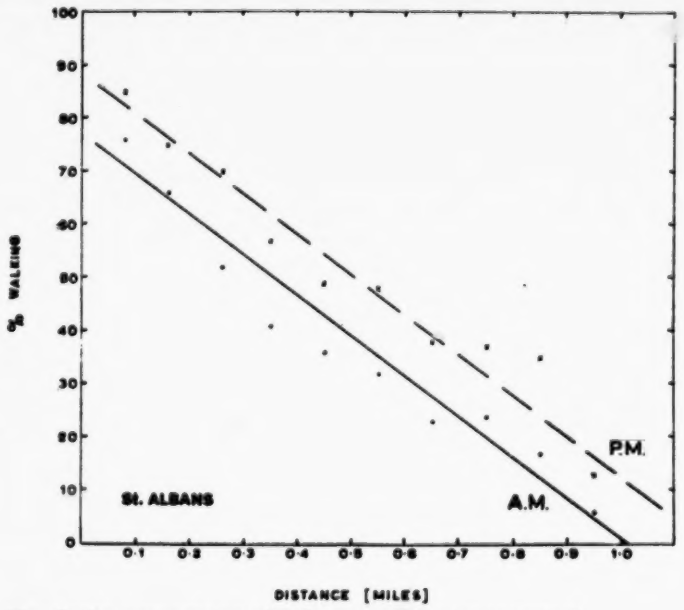


Fig. 6: the percentage of infants walking unescorted (W mode), by distance

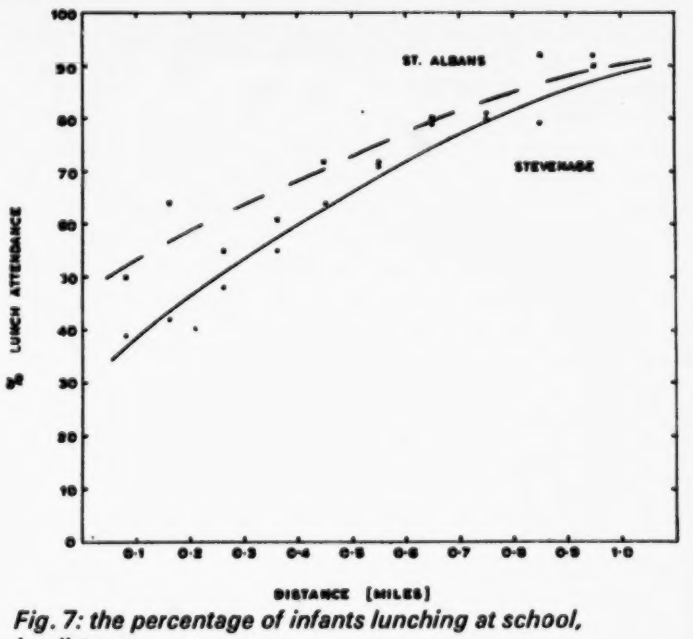


Fig. 7: the percentage of infants lunching at school, by distance

Another variable dependent on distance is the number of children who take lunch at school. The percentage of children having school lunch, in each of ten groups at increasing distances from school, is shown in figure 7. The dependence on distance is strong, especially in Stevenage, where 40% of children living close to the school, but 90% of those living a mile away, stay for lunch. The differences between Stevenage and St Albans are not great, except at the lower distances, when fewer Stevenage children stay for lunch. One likely explanation of this difference is that, owing to the fairly crowded state of most of the Stevenage schools, those children living very near school are encouraged by the school to go home for lunch in order to ease the pressure on dining facilities. Lunch attendance increases with age as well as with distance, and the opinion was indeed voiced to us both by parents and by teachers that younger children in particular benefited from a break from school at mid-day.

Let me summarize these findings about mode of travel and lunch in the following proposition:

If the walking distance from home to school is less than 0·4 miles, it is highly unlikely that under normal circumstances a parent will consider the use of a car to be necessary. Thus the greater the proportion of distances below 0·4 miles, the less a primary school will act as a generator of two-way car traffic—in particular the smaller will be the number of cars parked outside the school at 3.30 p.m. If the distance is less than 0·5 miles, the school is highly likely to be regarded as 'reasonably near', and a decision as to whether a child should lunch at school or should lunch at home can be made by the child or parent on grounds other than distance. The greater also will be the alternative dining resources should those of the school become over-strained (as might happen if temporary additional classrooms but not central facilities were added to cope with a birth rate bulge or with the extended duration of primary education recommended in the Plowden Report). It should be emphasized that no sudden change occurs at distances of 0·4 or 0·5 miles; they are merely the shortest distances at which two-way car usage and the verdict of 'not reasonably near' begin to appear and the proportions in these two categories at distances of (say) 0·45 and 0·55 miles respectively are very small (although greater under St Albans conditions than those of Stevenage).

Besides the CC mode, the CW mode is also of particular interest. Although for more than one reason a parent may feel it more important to escort a child in the morning than in the afternoon, the shortness of many journeys for which this mode is used suggests that the use of the car in the mornings is often not motivated by need, and our interviews with parents confirm this. Use of the CW mode seems merely to indicate the existence of the opportunity for the parent to take the child to school without inconvenience. Thus we have this proposition:

If a parent's journey to work by car conveniently takes him past his child's school, he may well take the child even though the journey is as short as 0·2 miles and is regarded as safe (most of these children will walk home unescorted after school). If the two journeys do not conveniently coincide, a child is not likely to be taken such a short distance by car.

The safety of the journey to school

That every primary school child should be able to reach school safely is an ideal to which every adult would subscribe. A planner's goal must evidently be to minimize, so far as he can, the probability of an accident occurring. From our analysis of accident records it is clear that a high accident rate is often associated with certain types of location as well as with certain types of behaviour, and some inferences can therefore be drawn as to the relative hazards of an existing or proposed plan. It is of interest to see how well accident figures correlate with parents' assessments of the hazard of the journey to school, on which we have direct evidence from interviews and indirect evidence from data on mode of travel. We found from our interviews that a parent benefits in two ways from escorting a child—first, by ostensibly lessening the risk of an accident through being able to control the child's behaviour; and second, by gaining the reassuring knowledge of the fact that the child has reached school safely. Presumably both of these benefits will be related to the subjective assessment of the risk run (the greater the risk the more the knowledge of a safe arrival will be worth) and so our figures on the proportion of children accompanied by their parents will give an indication of the collective assessment of risk. In fact over 80% of the parents interviewed who accompanied their child mentioned some sort of risk as the reason, the journeys of the remainder being work journeys or else motivated primarily by the desire to do shopping or meet friends, the child being accompanied incidentally.

The situation most commonly giving rise to anxiety occurs when a child has to cross a main road, and indeed in Stevenage 67% and in St Albans 59% of all injuries sustained in road accidents by children 5–11 years old were sustained on main roads. There is a sharp distinction between the two towns in one respect however. Of all injuries sustained in accidents on main roads, 40% in Stevenage but only 17% in St Albans were serious or fatal. In other words, an accident on a main road in Stevenage was more than twice as likely to be serious as one that occurred on a main road in St Albans, and it is therefore surprising that of children who have to cross a main road, the proportion accompanied by an adult in both directions is so much higher in St Albans. However this behavioural characteristic does correlate with our finding that while in Stevenage only 5½% of all accidents to primary school children were probably caused on a morning journey to school and only 3½% on an afternoon journey home, in St Albans 23% of all accidents to children seem to have occurred on a morning journey to school and 7½% on an afternoon journey home. The striking difference in the morning accident rate in the two towns may well be due in part to the different time of the peak hour for traffic, which lasts roughly from 7.30 to 8.30 a.m. in Stevenage and from 8.00 to 9.00 a.m. in St Albans. Thus in Stevenage there is a stronger element of time segregation than in St Albans between the work journeys of adults and the school journeys of primary school children. In St Albans moreover the children's journeys are on average longer and therefore tend to begin earlier. It would appear, then, that parents may be fairly sensitive to traffic volumes, although of St Albans children who have to cross a main road, the proportion accompanied by an adult on the afternoon journey is in the main not substantially lower than the proportion accompanied by an adult on the morning journey.

Over the five years 1962–66, there were a total of 120 injuries to primary school child pedestrians in Stevenage (78 slight, 39 serious and 3 fatal) and 80 in St Albans (68 slight, 11 serious and 1 fatal). The corresponding total injury rates are 2·97 and 3·16 per thousand children per year. We do not know why the serious injury rate is more than twice as great in Stevenage as in St Albans: presumably the speed of the vehicles involved is greater in Stevenage, and our own subjective impressions support this.

Accidents in Stevenage are concentrated on the district distributor roads (mainly running north–south), which have lower traffic flows and more junctions per mile than the primary distributors. In St Albans too there is a tendency for the number of injuries per mile of road to be higher on those main roads that have the smaller traffic flow. One would expect the injury rate on a given piece of road to depend not only on the amount of traffic flowing along it but also on the flow of child pedestrians across it. Unfortunately it is difficult to measure this flow with any precision. It is far less well channelled than vehicular traffic, and its pattern is likely to have changed more irregularly over the past five years. Moreover the majority of injuries appear to have been sustained not on school journeys but on leisure journeys, on which we have no information.

In Stevenage, traffic from one part of the town to another is firmly canalized, so that it has to use primary and district distributor roads, and housing areas are thus largely protected from through traffic. This is not the case in St Albans, however, where many residential roads can be used as short cuts. This difference may contribute to the proportion of all injuries that are sustained on minor roads being slightly higher in St Albans (41% as against 33% in Stevenage). The closeness of the overall injury rate in the two towns suggests that Stevenage children, although they live in more protected housing areas, are no more vulnerable than

St Albans children when they venture across a road. In both towns close on 90% of injuries were said to result from the child running into the road or stepping off the kerb without looking, although a stationary vehicle was involved slightly more often in St Albans.

As far as the road network is concerned, then, we would formulate, tentatively, the following proposition:

Such comparison of Stevenage and St Albans as is possible suggests—although a causal relationship cannot be demonstrated—that if a road network is of hierarchical form, in which traffic from one part of the town to another is forced to travel via primary and district distributors on which few or no shops, etc. front directly, and if no underpasses at all are provided, a much higher proportion of child pedestrians in the 5–11 age group are likely to suffer a serious injury in crossing a distributor road than would be the case in a town of similar size with a traditional pattern of roads and land uses, in which traffic can filter through side streets and the main roads serve as service roads for shops, etc. as well as acting as primary distributors. The hierarchic network doubtless offers greater potential for the elimination of accidents to pedestrians since it allows a much greater degree of segregation of the well-canalized pedestrian and vehicular flows, but if this potential is to be realized it would appear to be necessary to underpass not only primary distributor roads but also district distributors of the Stevenage type, even if they carry peak-hour traffic flows of as little as 500 vehicles per hour.

The safest way of conducting pedestrians across a main road is obviously by providing an under- or over-pass for them. For an underpass to be taken full advantage of, its use must involve the minimum penalty in extra distance compared with the shortest alternative practicable route, otherwise there will always be the temptation to take the short cut. The implication of this is that where children have to cross under a road to get to school, the school should be situated as close to the underpass as possible: the underpass is then as close to the convergence of all the routes as it can be and adds the minimum, if any, extra distance to a journey. This condition is in fact quite well satisfied by the underpasses in the part of Stevenage studied by us. In St Albans it is difficult to see where one would situate underpasses if the money for them were made available.

Even if there is no underpass, where part of a school's catchment area is unavoidably separated from the school by a main road there will be an advantage in having one entrance to the school fairly close to the road—as long as no more children have to cross the road than would otherwise do so—in that the children crossing will all do so at the same point, and a crossing patrol situated there can be of most value. The presence of a patrol was remarked on with appreciation by several parents, particularly in Stevenage, but head teachers mentioned the difficulty of getting someone to do this job (which involves four separate periods of work during a day) and a few parents had been disillusioned by unreliable patrols. There had moreover been two accidents involving children crossing a road with a patrol, one child having been killed and three injured.

Where, as in Stevenage, a cycleway and a footpath frequently share the same underpass, the routes of cyclists and moped-riders and those of pedestrians are likely to cross, since the underpass may well be at a junction of routes. The two types of user may also be in close contact on other paths from which four-wheeled traffic is excluded. Some parents expressed fears about the hazard to children in these circumstances, but the footpath/cycleway system in Stevenage has made only a small contribution to the overall accident rate, there having been two injuries (one slight, one serious) in the five years 1962–66. A secluded footpath also gives rise to fear of a child being molested.

Although children leave school in the afternoon well before the peak period for motor traffic, hazards do exist at that time. Some parents mentioned the danger caused by parked cars outside a school, containing other parents waiting for their children, and a stationary vehicle has indeed been a factor in approximately three out of ten accidents to children in the 5–11 age group in both towns. An in-

Extramural use of a bridge carrying a primary distributor over a footpath and a cycleway on which two children are standing. (Stevenage)

Three mothers about to cross a primary distributor with their children. Just up the road—an underpass. (Stevenage)

vestigation by R B Lenthall of the Stevenage Development Corporation has shown that hazards are caused not only by parked cars but also by parents gathering in groups on the pavement outside the school entrance. When a child wants to cross the road the parked cars may prevent him from seeing or being seen by approaching traffic, but even when a child wants to stay on the same side of the road he may have to go out on to the carriageway to get past the waiting parents. Under these circumstances hazard evidently does exist, especially since children emerging from school seem to do so with a spontaneous burst of energy that may send them darting hither and thither, a characteristic frequently observed by us and elegantly and dramatically demonstrated by Lenthall in a time-lapse film of a school entrance between 3.30 and 4.00 p.m. This film also showed the relative ineffectiveness of kerbside barriers in checking the onrush of children.

On this evidence there is clearly a need for pedestrian as well as vehicular traffic management. The Plowden Report also has drawn attention to the problem of providing space for parents to meet and talk at school entrances, and it would seem that such spaces would need to be set back from the pavement, which in turn might need to be set back from the carriageway. Parking restrictions should help to prevent parents from parking cars in the road outside the school gate, especially if some off-street parking places were provided. A suggestion for reducing the likelihood of children darting into the road has been incorporated in our fourth proposition, with which we conclude this section on road safety:

Should a school be unavoidably separated by a main road from some of the dwellings that it may serve, if by some means the children leaving school are funnelled from the exit towards the main road so that they will not have fanned out by the time that they reach it, a well-defined crossing point will exist. Fanning out will obviously be least if the school is situated alongside the main road, but children may then dart into the traffic. If the school exit is set back 80 yards or so from the road, much of the emerging children's initial burst of energy will have spent itself. Gymnastic playthings—a low fence to balance on, boulders to jump from, trees to climb—will aid this process. If a space at the exit is set aside for waiting parents, emerging children will not be forced into the roadway to get past groups of parents on the pavement.

Parked cars on the service road and both sides of the main road make life awkward for pedestrians, crossing patrols and other motorists. (St Albans)

The homeward rush begins, with a burst of exuberance. (St Albans)

The accessibility and 'draw' of a school to parents

The Plowden Report laid a good deal of emphasis on the need for establishing better contacts between schools, parents and the community. One of its recommendations was in fact that 'much further thought' should be given to 'siting and planning schools so that they are more accessible to parents and the community, and free from traffic dangers and other nuisances'. This recommendation, which reflects the current pressure to use primary schools for community facilities, and as fully as possible out of ordinary hours, presumably arises from the fact that while children are compelled to go to school parents are not: they must be attracted. Even so, it is still a little hard to see why accessibility to parents is specifically mentioned. One would expect that a school situated so as to be most accessible to children would automatically be most accessible to parents. If it is not, this implies that the accessibility needs of parents and children conflict, in which case one would expect those of the children to take priority. Moreover accessibility in itself does not motivate parents to visit the school; it merely reflects the opportunity for (i.e. ease of) doing so.

Are there benefits to be gained by the school and the community from parents meeting and talking at a school entrance? The Plowden Committee felt that 'one of the essentials for educational advance is a closer partnership between the two parties to every child's education'—school and parents. Schools which had outstandingly good relationships with parents 'made a practice of involving them in all sorts of ways, small as well as large'. It is reasonable to expect that this involvement will if anything be facilitated rather than hindered if the school entrance becomes something of a social centre for parents. Certainly the provision of 'space for parents to meet and talk at the entrance, space to set up a bookstall, for example, showing good children's books' was regarded by the Plowden Committee as a problem calling for further thought.

In Stevenage and St Albans at present,

the most compelling reason why parents come to the schools is to ensure that their children make the journey safely. In an ideal plan, a child's safety would be more assured. For what other reasons will a parent collect a child from school (the afternoon being the time when most social intercourse takes place, while parents wait for their children)? Unless a parent happens to be passing by on the way home from work, some positive motivation will be needed. This could take the form of a desire to meet and have a chat with other parents, or a desire to call at shops which are very accessible to the school, so that minimal extra effort is required to call at the school itself.

The desire to meet other parents seems to be weaker than the shopping motivation and much weaker than the safety motivation, since where—as for school G in Stevenage—distances are short and few children have roads to cross, and there are no shops near the school, the proportion of parents who collect their children is strikingly low. It can be quite sizeable, however, even when the safety consideration is absent, if there are shops accessible. This is shown by our finding that a shopping trip was usually combined with accompanying a child by 24 out of the 60 Stevenage parents interviewed who habitually accompanied their children: of those 24, 7 said that the walk was a safe one for children. The strong association in parents' minds, revealed by the interviews, between the convenience of a school's situation, and the proximity of shops to the route to school, also supports this conclusion. Parents who accompanied their children were asked whether the school was conveniently situated from their point of view. The definite 'yes' outnumbered the definite 'no' by about 7 to 1 in Stevenage and 3 to 1 in St Albans. Of those who said that the school was conveniently situated, approximately half in Stevenage and a quarter in St Albans spontaneously mentioned shops, using a phrase such as 'it's handy for the shops' or 'I meet them at the shops'. It would seem that convenience depends not only on the location of the school with respect to the home but also on the ease with which other activities, especially shopping, may be combined with escorting a child.

The high proportion of escorted children at school E in Stevenage is without doubt due at least in part to the location of the school. It is situated very close to a neighbourhood shopping centre (22 shops plus a rent office and welfare clinic), and there is a small paved and grassed square, but no roadway, between the school and the shops. At 3.30 on a fine day it can be seen thronged with mothers, many talking to each other, waiting for their children.

We feel then that there is sufficient evidence to justify the following proposition, again one in which we have put forward suggestions as to layout:

If a school is situated near a centre containing a reasonably comprehensive range of shops and other communal facilities, with a small pedestrian precinct between the shops and the school, some mothers are likely to wait for their children following a shopping trip and to make and meet friends, even if they do not feel obliged to accompany their children for reasons of safety. The school entrance will thus become something of a social centre for parents, a small but possibly significant step towards involving parents in the life of the school—an objective to which the Plowden Committee attached some importance. It would of course be preferable to segregate child pedestrians from vehicular traffic generated by the shopping centre, especially if it were on a main road: an underpass at this location could serve both school and shops. A car park could do the same. If it were on the opposite side to the school, it is possible that a parent arriving by car might be induced to leave it there rather than outside the school entrance where it would constitute a hazard. The number of dwellings required to support such a shopping centre would undoubtedly be greater than the number which would support a single primary school (unfortunately we cannot be specific about the number of shops needed for such a centre to be an attraction) and it might therefore be worth investigating the feasibility of locating two schools near one such centre.

System flexibility and the freedom of choice of school

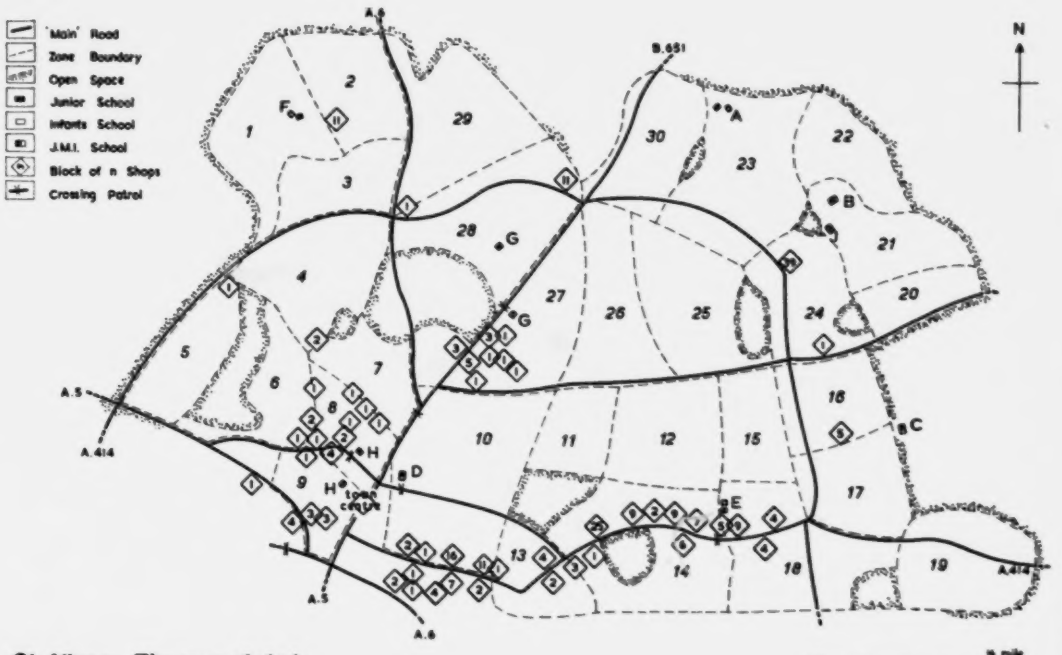
On our large-scale maps of the two towns, the home of each primary schoolchild was marked with a colour code corresponding to the school and department he or she attended, so that one could differentiate between infants and juniors as well as between schools. The patterns for the county primary schools in Stevenage and St Albans were noticeably different.

The pattern in Stevenage resolved itself fairly neatly into twenty zones (figure 9), of different sizes. Eight of them (zones 1,3,5,6,8,11,15,18) can each be said to be the province almost exclusively of one county primary school. The remainder were shared by two or three such schools and it was impossible to sub-divide them by eye into non-overlapping constituent parts. Fewer than 2% of the children attending these schools lived outside the zoned area. To achieve a similar resolution in St Albans it was necessary to divide the area into thirty zones (figure 8), nine of which were devoted mainly to a single school (zones 1,2,5,6,8,14,18,21,28). These thirty zones contained on average only 95 children as against 256 for Stevenage. Nearly 10% of the children attending these schools lived outside the zoned area.

The question that now arises is this. Why do children living in the same zone attend different schools? Or, to put it a slightly different way, why do the catchment areas of different schools overlap? There seem to be three contributory causes: (i) families moving to a different house, the child continuing to attend the same school; (ii) permitted freedom of choice of school, parents living in the same zone choosing different schools; and (iii) relocation, over a period of time, of the boundary between catchment areas. We came to the conclusion that the movement of catchment area boundaries was the most important factor.

Unfortunately it is difficult to demonstrate this absolutely rigorously. Because there are three entries a year of children to infants school, the sample entering at any one time is necessarily a small one. Moreover it is commonly felt to be desirable that a child should be allowed to go to the same school as an older sibling, even if their home is no longer within the school's catchment area, and this can therefore confuse the issue. What we have done instead is to compare the geographical distribution of infants with that of juniors. In effect, this is to compare the catchment areas that existed when the infants started school with the catchment areas that existed when the juniors started. The comparison will not be entirely valid because a proportion of juniors will not have attended the associated infants school,

Fig. 8



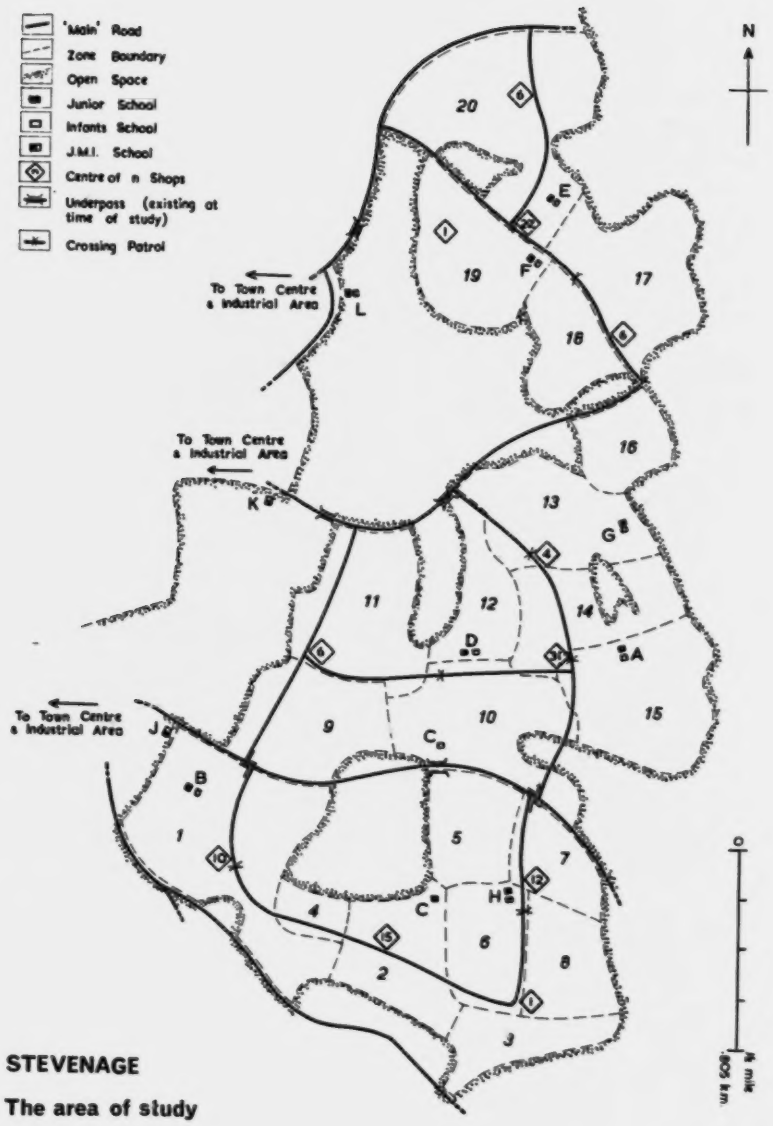
St. Albans The area of study

possibly because they had changed schools at the age of 7 or because the family had recently moved house. Nevertheless these will in the main be isolated occurrences. In fact a number of significant changes in catchment areas were observed in both towns.

In zone 9 in Stevenage, for example, the majority of the juniors at county schools attend school D, but the majority of the infants attend school B. Thus zone 9 is in the process of being transferred from the catchment area of school D to that of school B. Several other zones are in a similar state of transition. This phenomenon is shown graphically in figures 10 and 11, in which the zones in process of transfer are represented by numbered arrows pointing in the direction of the school that is taking over. As can be seen, such transfers link six schools together in Stevenage and four in St Albans. Why do they take place?

These transfers result from arrangements between the managers of adjacent schools, reached in consultation with head teachers and the Divisional Education Officer. In a nutshell, their purpose is to prevent class sizes in one school from being materially larger than those in another. As the Stevenage example shows, the effect when a number of schools are linked together is to even out quite sizeable peaks in the demand for places. (Thus the infants bulge in the area of school G is partly shed on to schools A and D, the latter passing it on to schools B and C.) However this can only occur if there are spare places in the neighbouring schools. If not, it is necessary to provide new places, usually done by adding one or more pairs of temporary classrooms to an existing school or by building a new school. When this happens, there may temporarily be an excess of places over pupils at that school, and transfers will begin to take place in such a way as to use up this spare capacity. (This happened with school C in Stevenage and with school A in St Albans.) To generalize, when the equilibrium of a system of linked primary schools—which holds when there is parity of class size throughout the system—is disturbed, whether by introducing new demand or new supply, the system is able to react in such a way as to share out and absorb the new demand or to spread the benefits of the new supply. In other words, such a system possesses flexibility, and can respond to changes in demand and supply from time to time and from place to place.

The greater the disturbance to such a system, the larger it needs to be for the disturbance to be smoothed out. It is not possible, on the evidence of this study, to state what the optimum number of linked schools is, or indeed whether there is such a thing as an optimum number. At the time of the study in Stevenage no more than six were found to be linked together although the opportunity was present for more to be, and it may be that if an excess of demand, say, is so great that a group of five or six county schools cannot absorb it, what is needed is a new school.

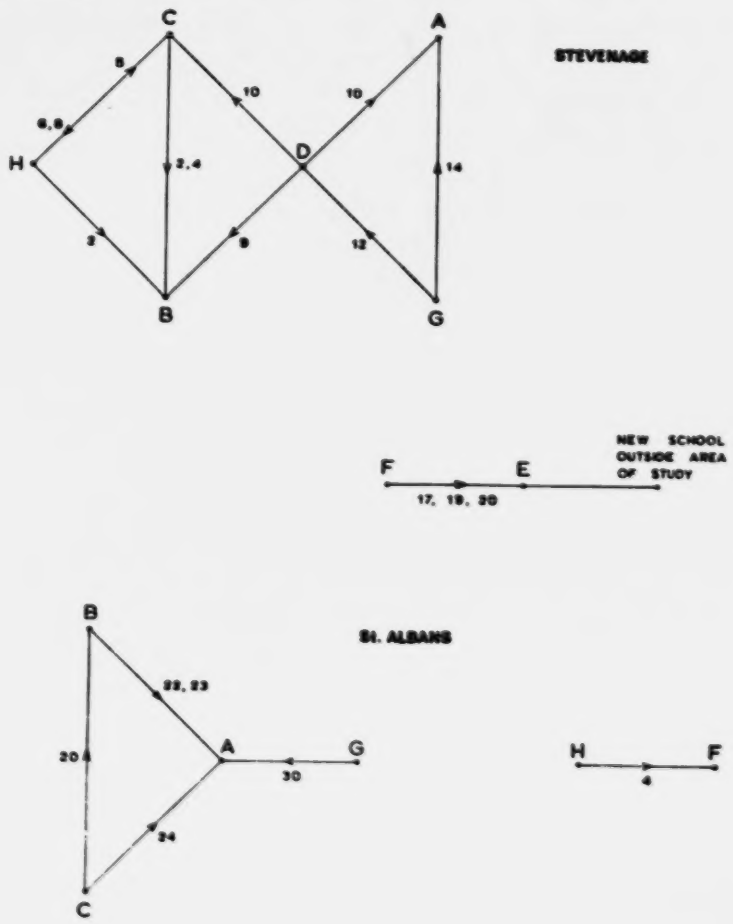


STEVENAGE

The area of study

Fig. 9

Figs. 10 (Stevenage) and 11 (St Albans): networks showing net transfer of children between schools. The numbered arrows point to the school with disproportionately many infants in the zone of that number



There seems to be no difficulty, then, in recognizing the motivation behind these catchment area movements. But to carry them out requires the opportunity as well as the motivation. The opportunity lies in the feasibility of children in many residential areas, particularly in Stevenage, attending any one of two or more schools without travelling any great distance. Consequently a group of dwellings can be transferred from the catchment area of one school to that of another without imposing much, if any, burden in terms of journey distance.

It is worth pointing out here that the voluntary schools are not linked with the county schools in the way that the latter are linked among themselves, except that when a new voluntary school opens some parents may choose to transfer their children to it from the county school that they have hitherto attended. Because there is only a minority of voluntary schools in the areas studied, and because the motivation to send their child to a voluntary school is a strong one for a minority of parents, some children travel considerable distances and the catchment areas are thus much larger than that of a county school with the same number of pupils. In a town with a greater proportion of R.C. schools, say, these would doubtless be linked among themselves in the same way as the network of county primary schools.

It is pertinent to ask why it is that the variable and unforeseen demand for primary school places that has been experienced in Stevenage and other new towns has brought with it such great problems of accommodation. After all, a two form entry primary school for classes of 30 children, which will accommodate an annual intake of 60 children can without excessive hardship be extended by the use of temporary classrooms to three form entry and the class size raised to 40 children. It will then accommodate an annual intake of 120 children. Obviously a single school is considerably elastic, and it is a measure of the problems that have arisen in Stevenage that even a contingency allowance of this magnitude has been inadequate.

There are of course drawbacks to expanded schools. To enlarge a school simply by adding temporary classrooms is to overload the central facilities (hall, dining room, cloakrooms, staff room, etc.) and outdoor play area, which may indeed be diminished if the classrooms are put in the playground. To enlarge an existing two form entry school to three forms entry will clearly cause less strain than to enlarge an existing one form entry school to two forms entry—a 50% overload as opposed to a 100% one. This is perhaps worth noting in view of the fact that planners have recently suggested the use of some one form entry schools in new developments. The Plowden Committee's expressed preference is for two or three form rather than one form entry.

The birthrate problem in parts of Stevenage is still acute. In zones 17–20, the Chells neighbourhood, within which two county primary schools are located, a 10% household survey carried out by the Stevenage Development Corporation[4] found that in 294 dwellings there were 210 children under 5 years old, equivalent to an annual birth rate sustained over 5 years of 0·143 births per dwelling—resulting in a total demand within these four zones for an annual intake of just over 400 children, or ten forms entry. (For reference purposes it may be noted that there is an average of 2·83 bedrooms per dwelling within this area: 73% are 3-bedroom and 17% are 2-bedroom. Construction of the area took place mainly within the period 1960–65.) One might add that if the Stevenage birth rate is reached in the next generation of new towns, to judge by some recent master plans they are going to be quite as short of school places as ever the mark I new towns were.

There is good reason for expressing birth rate in terms of births per dwelling. It looks very much as though the habit of expressing birth rates in terms of births per thousand population is at least partly responsible for the misleading projections that have been made in the past. Extrapolating backward from the figures for the Chells neighbourhood, Stevenage, a sample of 7,500 people producing 420 births per annum in 1961 will have registered a birth rate of 56 per thousand. The same number of households, swollen with young children to 9,600 people five years later and still producing 420 births per annum, will register a birth rate of 44 per thousand. The apparent drop in the birth rate will obviously not be matched by a drop in the annual demand for school places.

The duration of the bulge will depend to an extent on the speed of construction. The faster it is, the sharper and higher the bulge. Conversely, the slower the rate of construction, the flatter the birth rate curve and the longer the duration of the transient state. Its duration will also be prolonged as a result of the turnover of households. Many of the families who leave the area after their children have passed through primary school will be replaced by younger families similar in age, composition and fertility to the original settlers.

So much for the problems caused by high birth rate, which give rise—as we have seen—to well-defined catchment areas. When the demand slackens, a certain amount of parental choice is clearly possible. The Plowden Report attached some importance to parental choice of school and recommended that 'parents should be allowed to choose their children's primary school whenever this is possible'. Given this freedom, what will a parent do with it? In Appendix 3 of the Report[5] it is stated that reasons of accessibility were, collectively, given most frequently for selecting a school: it was the most convenient for the child to get to or it was the nearest or safest to reach or there were no main roads to cross (49% of parents who had a choice of school). Evidently, as the Plowden Committee observed, freedom of choice in an area with only one accessible school is a very nominal freedom. If freedom is to be used to make a choice on educational grounds it will obviously be necessary for there to be at least two schools both of which satisfy parents' accessibility requirements for their children.

It is interesting that this condition is automatically satisfied if the condition for flexibility of a system of schools is satisfied. Thus whether demand is low and the aim is to maximize parental freedom of choice, or whether demand is high and the aim is to spread the children evenly over the schools and classes available, the demands on the layout are that each dwelling should have a choice of schools within easy reach. If this is so, the plan will allow the education authority the maximum scope for action in response to future changing demand, making decisions on the allocation of children itself when demand is high and allowing parents to do so when demand is low. The planner is thus allowing for changing demand—and is doing so by making decisions that restrict as little as possible the future freedom of the administrators of the primary education system.

Let me now summarize these findings in our final proposition:

In an area of rapid housing development, birth rate—and the subsequent demand for primary school places—may rise rapidly to a quite high level (locally a figure of the order of 1 birth per 7 dwellings per annum may be reached) before beginning to fall. Accordingly, in a large area of development the peak will move from zone to zone in the sequence in which the zones were constructed. School accommodation cannot easily be matched to such a variable and mobile demand, and in general it is not possible to do other than distribute it more or less evenly over the area to be served. If this area contains enough dwellings to support five or six county primary schools, and if each dwelling has within half a mile or so two or more schools that can be reached without making a dangerous crossing of a main road (to attain this overlap of feasible catchment areas the schools are likely to be grouped towards the centre of the area rather than dispersed towards its periphery), there is a good likelihood that even when the total demand in the area is approaching the total available capacity administrators will be able—by allocating children to schools as necessary—to attain the goal of approximate parity of class size throughout the area, in spite of there being peaks of demand in some zones and troughs in others. Moreover when capacity comfortably exceeds demand, the maximum number of parents can have a real freedom to choose their child's school—another educational ideal. An area of this size will, in addition, support one or perhaps two voluntary primary schools. If, on the other hand, the Dudley Committee's recommendation of neighbourhoods separated by main roads or green wedges, and each supporting only one or two primary schools, is followed, there is a very high probability that for some time a substantial proportion of children will have to attend a school outside the neighbourhood in which

they live, and will suffer some hardship in doing so. This could be avoided only if the money were available to equip every neighbourhood with enough school places to accommodate its peak demand: this finance would be being used to supply school places in one part of a town even though there were empty places in other parts.

We very much hope that the propositions which we have put forward in the course of this paper will be of use in drawing up and assessing plans for new urban developments. We have already begun to work with planners in applying these propositions and hope to continue to do so, since there are surely more lessons to be learned from trying to put them into practice.

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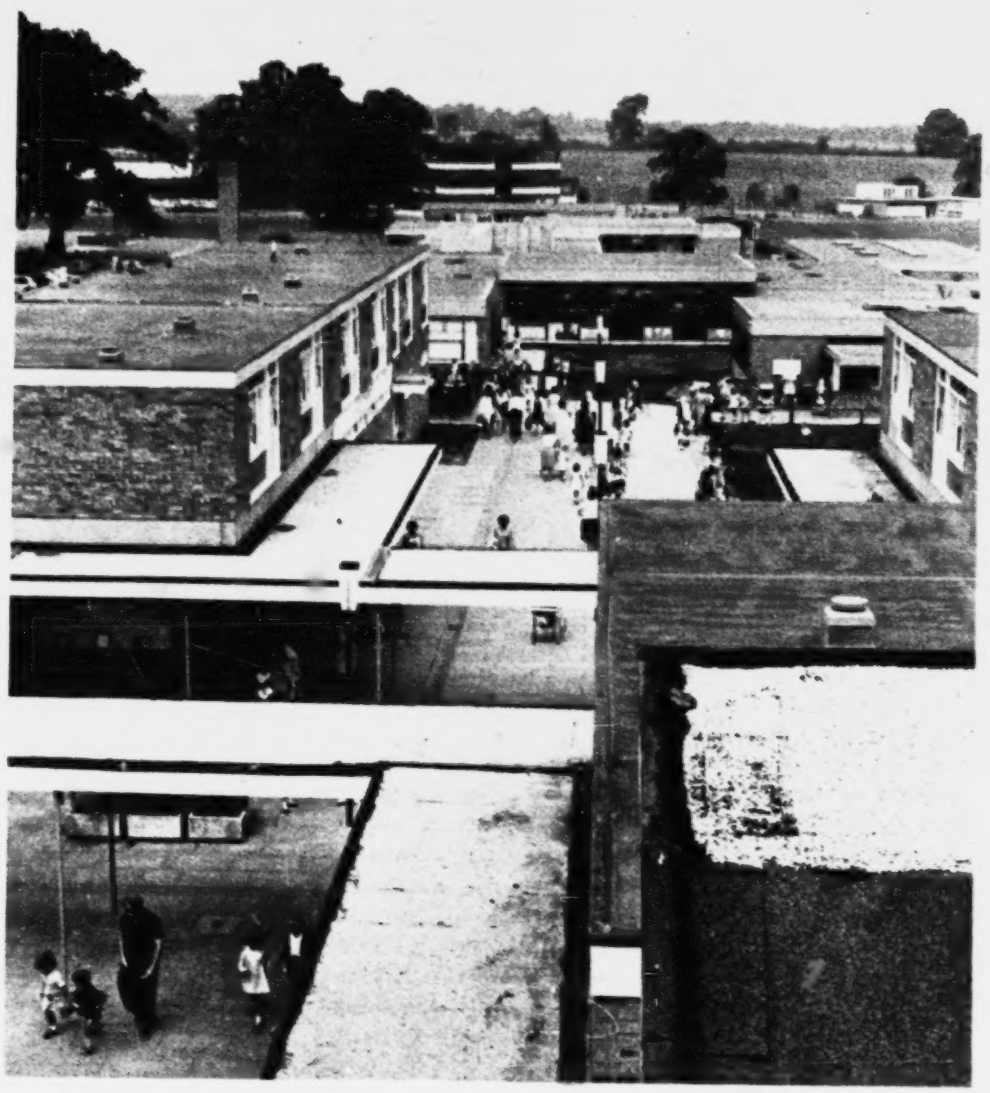
(a) School E at Stevenage adjoins the Glebe Neighbourhood Centre. The school entrance linked to shops makes a useful, safe and attractive place for parents to gather.

(b) After school, parents and children filter through the shopping precinct.



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